TRACE EVIDENCE DATA WORKSHOP: IMPROVING TECHNOLOGY AND MEASUREMENT IN FORENSIC SCIENCE

Date:

July 19-20, 2016 @ 8:30am

Location:

National Institute of Standards and Technology
Building 101, Heritage Room

SPEAKER ABSTRACTS AND BIOS

DAY 1 – July 19, 2016

Plenary Session

The role of reference collections in trace evidence

Christopher S. Palenik, PhD, MicroTrace

Abstract: "The list is the origin of culture." This statement by author and philosopher Umberto Eco provides an indication of the central role that lists play in society. Certainly lists and the physical collections upon which they are often based go back to the earliest days of forensic science. Even Sherlock Holmes enumerates "Upon the Distinction between the Ashes of the Various Tobaccos" in his fictional monograph. Yet while we live in a world more dedicated to organizing, characterizing, and standardizing than ever before, materials collections in trace evidence remain underdeveloped. There are certainly reasons for this, such as the difficulty of obtaining samples, organizing samples, a likely low frequency of direct casework application, and the expectation that errors will exist even in the most carefully curated collections. Yet, beyond the existential pleasure that many of us take in such collections, there is an inherent value both to casework and the continued development of the supporting science. Through our decades of experience curating various physical collections, applying these collections to cases, and first hand experiences related to the limitations, uncertainties, and errors that may be associated with such collections, I hope to share our enthusiasm for the topic and the value it has brought to our own expertise in trace analysis.

Biography: From his earliest memories in his Father's basement microscopy laboratory, to houseguests from laboratories at Scotland Yard, the Soviet Forensic Service, and many US crime laboratories, the breath of information hidden in scientific clues and the practical value of this information has always fascinated Chris.

Following his formal education at the University of Chicago and University of Michigan, Chris has had the fortunate opportunity to continually expand his knowledge of chemistry, geology, materials science, and nuclear engineering while applying it to a wide variety of unusual investigations. With projects that have included capital punishment cases, military court martials, and civil litigation and clients from pharma, food, environmental and nanotechnology industries, he has encountered a range of scientifically fascinating and newsworthy cases. Some of the more unusual samples have included a holocaust era lamp shade allegedly made of human skin, baseball bats and balls signed by the likes of Joe DiMaggio and "Shoeless Joe" Jackson, materials from unlicensed cosmetic surgeries, and a wide assortment of alleged pills, animal parts, and other miscellanea allegedly encountered during the consumption of food.

The application of microscopy to a variety of unusual questions through a rigorous application of the scientific method provides an elegant link among this seemingly disparate ranges of clients, materials, and fundamental sciences. The outcomes of these investigations have been accepted in courts, published in peer reviewed journals,

presented at meetings, and featured in media ranging from the National Geographic channel to NBC's Today show. Chris is a fellow of the American Academy of Forensic Sciences, and serves in appointed positions on the North Carolina Forensic Science Laboratory Advisory board and the National Institute of Justice Forensic Science Standards Organization (OSAC).

What Does the Future Hold for Trace Evidence?

Claude Roux, PhD, Centre for Forensic Science, University of Technology, Sydney, Australia

Abstract: Trace evidence is an area that is seminal to forensic science both for epistemological and historical reasons. There is however little doubt that trace evidence currently faces significant challenges worldwide. In the worst case scenario some even predict the disappearance of this sub-discipline in the routine practice of forensic science in the near future. Current and future challenges along with some possible answers are discussed in this presentation. Improving the availability and reliability of contemporary data is undoubtedly part of the solution. However, it is also argued that reference data and databases alone should not be seen as the panacea and that more fundamental issues should be considered in priority. In particular, such data are of limited value if the right questions are not asked, being during the intelligence, investigative or evaluative stage of the process. The same comment applies to the construction of any database. In other words, data must be fit for the intended purpose and must be used within appropriate intellectual and logical frameworks. The current situation ultimately presents some significant opportunities to re-invent not only trace evidence but also forensic science. Ultimately, a distinctive, more robust and more reliable science may emerge through rethinking the fragmented forensics paradigm built on specialisms, revisiting fundamental forensic science principles and adapting them to the 21st Century.

Bio: Claude Roux is Professor of Forensic Science and the founding Director of the Centre for Forensic Science, University of Technology, and Sydney, Australia. He obtained a BSc and a PhD from the University of Lausanne, Switzerland. Claude's research activities cover a broad spectrum of forensic science including trace evidence and chemical criminalistics, document, fingerprints and forensic intelligence. His research has been largely driven by his vision of forensic science as a distinctive academic and holistic research-based discipline. He published over 140 refereed papers and 25 book chapters and a large number of conference presentations. Claude is a member of the editorial board of six scientific journals and of a number of working and advisory groups. He is the current President of the Australian & NZ Forensic Science Society (ANZFSS), the Vice-President of the Australian Academy of Forensic Sciences and a Fellow of the Royal Society of New South Wales. He also serves on the Scientific Advisory Board of the International Criminal Court, The Hague, The Netherlands.

R&D and Maintenance in the making of Successful Databases of Trace Evidence Materials

Edward G. Bartick, PhD, Department of Forensic Sciences, George Washington University, Washington, DC

Abstract: To avoid the situation of the adage "Garbage In - Garbage Out", sound analytical research, development of an accessible robust software platform, and maintenance of the data, software, and continually improved analytical methodologies are required. This is necessary to produce successful and sustaining utilization of databases whether used for trace evidential materials data or other data. In response to the 2009 National Research Council report, the National Science Foundation and the National Institute of Justice, sponsored grant for a "Forensic Science Research and Evaluation Workshop: A Discussion on the Fundamentals of Research Design and an Evaluation of Available Literature". The participants reviewed problems associated with research in the forensic sciences and conducted presentations, discussions and a published report regarding what is necessary to improve the research and subsequently the robustness of the results. The three half day sessions included I. Experimental Design and Statistics, II. Interpretation and Assessment, and III. Policy Implications. These topics are important when considering

the development of analytical methodology and the use of data for trace evidence databases being funded through the government. As principal investigator and manager of the workshop, the presenter will review the workshop, provide examples, and explain how it applies to making successful trace evidence databases.

Bio: Edward G. (Ed) Bartick is a research professor at The George Washington University Department of Forensic Sciences, Washington, DC, who is involved in the development of forensic analytical methods of evidential materials. Dr. Bartick completed a Ph.D. at the Institute of Materials Science at U. Connecticut in 1978. He has worked for pharmaceutical, instrument, and a materials production companies doing analytical development. In 1986, he joined the FBI Laboratory as a research scientist in forensic methods development. In 1991 he started a one-week class entitled "Infrared Spectrometry for Trace Analysis" for forensic examiners. Dr. Bartick has acted as research advisor for Ph.D. and M.S. graduate students from U. Virginia, Virginia Tech, and George Washington U. on forensic vibrational spectroscopy thesis projects at the FBI Academy. In January 2007, He retired from the FBI to direct the Forensic Science Program at Suffolk U. in Boston where he expanded the curriculum. He returned to the Washington, D.C., area to join GWU 2013. Dr. Bartick has authored 60 technical publications, including 11 book chapters. He was awarded the FBI Director's Award in 1994 and 1996. In 1994 he founded the Scientific Working Group for Materials Examination (SWGMAT). He chaired the group through 1997 and continued to play an active role as chair of the Database Subgroup until spring of 2014 when the Organization of Scientific Area Committees (OSACs) at NIST assumed the role of SWGs. Dr. Bartick is a Fellow of the American Academy of Forensic Sciences, a charter member of American Society of Trace Evidence Examiners (ASTEE), a member of the American Chemical Society and the Society for Applied Spectroscopy.

Research Needs in Trace Evidence Analysis: How Can Better Data Help?

Gerry LaPorte, MSFS

Abstract: Forensic science often produces valuable evidence that can be used to successfully prosecute and convict criminals, as well as exonerate the innocent. Based on technological innovations and the evolution of the field in the past several decades, forensic scientists, as a whole, have continued to improve knowledge and better understand methods and practices. Fibers, hair, soil, wood, gunshot residue and pollen are only a few examples of trace evidence that may be transferred between people, objects or the environment during a crime – and then potentially used to link a suspect and a victim to a mutual location. However, after years of general acceptance about theories and fundamental concepts, the criminal justice system is now demanding scientists to demonstrate that the methods and practices employed in various forensic disciplines are based on accurate, reliable, and valid testing.

The National Institute of Justice (NIJ) is the federal government's lead agency for forensic science research and development as well as for the administration of programs focused on improving laboratory efficiency and reducing backlogs. To increase the value of trace evidence, NIJ funds research to improve and enhance the ability of the forensic science community to identify, analyze and interpret evidence. This presentation will highlight the ongoing efforts at NIJ in the area of trace evidence, where the main goals of this portfolio are focused on: i) the development of new tools and techniques to detect, collect and preserve evidence from crime scenes; ii) instruments that decrease the time and labor needed for trace evidence analysis; and iii) new approaches and enhancement of current approaches to interpreting trace evidence data.

Bio: Mr. LaPorte serves as the Director in the Office of Investigative and Forensic Sciences at the National Institute of Justice (NIJ), where their mission is to improve the quality and practice of forensic science through innovative solutions that support research, development, technology, evaluation, and information exchange for the criminal

justice community. His primary duties are to oversee the management of over $400 million in grants and to provide expert analysis and advice on agency-wide programs or issues of national impact relating to forensic science.

Mr. LaPorte received his Bachelor of Science and Business Administration degrees from the University of Windsor (Canada) and Master of Science in Forensic Science from the University of Alabama at Birmingham. Over the course of his 23 year career, he has worked in various capacities as a forensic scientist. Prior to joining NIJ, Mr. LaPorte was the Chief Research Forensic Chemist for the United States Secret Service.

Mr. LaPorte has over 20 publications, including chapters in three text books, and has presented over 100 lectures and workshops in 13 different countries. He is a member of various organizations including the American Academy of Forensic Sciences, Mid-Atlantic Association of Forensic Scientists, American Society of Questioned Document Examiners, and the American Bar Association. Mr. LaPorte served as the co-chair for the Standards Practices and Protocols Interagency Working Group under the Executive Office of the President of the United States and currently serves on the National Commission on Forensic Science.

The FBI's role in Trace Evidence Reference Collections

Cary T. Oien, Senior Level Scientist, Scientific Analysis Section, Laboratory Division, Federal Bureau of Investigation

Abstract: The FBI Laboratory has a long history of developing, maintaining, and providing access to reference collections to law enforcement agencies, beginning at the same time as the creation of the Laboratory Division. This talk will discuss a few of the current reference collections in use by the FBI Laboratory and available to state and local law enforcement partners. In addition, recent efforts to assist in the population of open-source databases and FBI Laboratory efforts to make some databases available on-line.

Bio: In March 2015, Cary Oien was named as Senior Level Scientist of the Scientific Analysis Section, Laboratory Division, Federal Bureau of Investigation. The Scientific Analysis Section is comprised of five case working units (Chemistry, Cryptanalysis and Racketeering Records, Firearms/Toolmarks, Questioned Documents, and Trace Evidence) as well as the Counterterrorism and Forensic Science Research Unit and the Forensic Analysis Support Unit. Cary previously served as Chief of the Scientific Analysis Section, Chief of the Firearms/Toolmarks Unit, and Chief of the Trace Evidence Unit. Prior to those positions, he served as a forensic examiner in the Trace Evidence Unit for eleven years, conducting analyses in disciplines of hair, fiber, fabric, fabric impressions, cordage, wood and feathers.

Analyst and Management Survey Results about Trace Evidence

Sandra Koch, Pennsylvania State University

Abstract: The OSAC Materials (Trace) subcommittee's Outreach and Initiative Task Group has a mission to establish promotional opportunities and create educational materials to counteract the undervaluing of Trace Evidence. In order to identify the perception, reality, and needs of the Trace Evidence community, surveys were recently disseminated to Trace Evidence analysts as well as lab management. Over 100 managers and 300 analysts responded. The results of these surveys will be presented along with plans for how this task group plans to proceed as a result.

Bio: Sandra Koch has a Masters in Forensic Science and worked for the FBI Laboratory Trace Evidence Unit from 1997 until 2013. She is a Fellow of the American Academy of Forensic Sciences, a founding member of the American Society of Trace Evidence Examiners and is certified by the American Board of Criminalistics in hairs and fibers.

Sandra is a past member of the Scientific Working Group for Materials Analysis (SWGMAT) and is currently a member of the OSAC Materials (trace) subgroup. Currently Sandra is pursuing a PhD in biological anthropology at the Pennsylvania State University, using her background in microscopical analysis to integrate forensic and anthropological analysis of hair.

Major NIST Efforts To Improve Data Access

NIST Wide Initiatives in Improving Data Access

Chandler Becker, PhD, Office of Data Informatics, NIST

Abstract: Efforts to improve access to NIST data will be discussed, particularly focusing on NIST policies in support of open data and the development of infrastructure and public-facing resources to facilitate access to public data.

Bio: Chandler Becker is a staff member in the NIST Material Measurement Laboratory's Office of Data and Informatics. Dr. Becker holds a PhD in Materials Science and Engineering from Northwestern University and works in areas related to improving access and usability of data and models, particularly as related to materials science as part of the Materials Genome Initiative. She was honored in 2011 with a Department of Commerce Bronze medal and in 2015 with the NIST Sigma Xi Katharine B. Gebbie Young Investigator Award.

NIST FSRP Data Initiatives: Biometrics Catalog and Reference Data Inventory

Shannan Williams, Forensic Science Research Program, Special Programs Office NIST

Abstract: The purpose of the presentation is inform attendees about two efforts managed by NIST in partnership with NIJ including the development of a catalog of publicly available biometrics datasets and an inventory of reference collections. Currently the Biometric and Forensic Dataset Catalog contains about 200 existing publicly available datasets of various modalities. The catalog contains information about the samples via a detailed taxonomy and serves as a pointer for researchers to obtain access to data supplied by host agencies. The catalog will be used as a basis for discussion among the biometric community to develop a path forward on expanding existing publicly available databases in early 2015.

Bio: Shannan Williams is a Project Manager in the Forensic Science Research Program in the Special Programs Office at the National Institute of Standards and Technology. She serves as a co-lead for the newly established research focus areas of trace evidence analysis and drugs/toxins analysis. Prior to her federal hire in 2015, she worked with NIST for nearly 6 years as a management consultant providing support in numerous projects ranging from biological evidence preservation to the collection of biometric datasets to assisting the launch of the Organization of Scientific Area Committees (OSAC). She obtained her Master's in Public Policy from the Harvard University Kennedy School of Government with a focus on organizational strategy and public administration. She obtained certification as a Change Management Practitioner from Georgetown University in 2011. Prior to joining NIST, Shannan worked on several state and local government initiatives focused on integrating science and information technology into programs focused on juvenile justice, education, and workforce development within the States of New Jersey and Maryland, and the City of Chicago Mayor's Office. She currently serves as a recently appointed member of the OSAC Quality Infrastructure Committee.

NIST Mass Spectral Database

William Wallace, Chemical Informatics Research Division, NIST

Bio: Bill Wallace has worked at NIST for 23 years, initially in the area of polymer surface and thin film characterization by laser, x-ray, and neutron methods, then in the creation of polymer molecular mass distribution Standard

Reference Materials by mass spectrometry, and most recently in the area of mass spectral libraries for forensic applications.

Abstract: Chemical compound identification by mass spectrometry is most often accomplish by comparison of the unknown compound spectrum to a library of pure compound spectra. The first NIST mass spectral library was created over 70 years ago and contained nine entries of hydrocarbons found in petroleum. Today's NIST mass spectral libraries contain in excess of 250,000 compounds. This talk will describe the NIST libraries and their application to forensics.

NIST Ballistics Toolmarks Research Database

Xiaoyu Alan Zheng, Engineering Physics Division, NIST

Abstract: The project objective is an open-access research database of bullet and cartridge case reference data, consisting of traditional reflectance microscopy images and three-dimensional surface topography. The database will foster the development and validation of advanced algorithms, mathematical similarity criteria, and quantitative confidence limits for objective ballistics identification.

In 2009, a report by the National Academies called into question, amongst other issues, the objectivity of visual toolmark identification by firearms examiners. The National Academies recommended development of a precisely specified, and scientifically justified, identification process that leads to results with well-characterized confidence limits. Industry, academia, and government laboratories are pursuing two promising approaches towards this goal: 1) development of mathematical criteria and advanced algorithms for the objective and automated classification of potential matches and estimation of associated error rates, and 2) supplementing traditional reflectance microscopy images with three-dimensional surface topography measurement data. Development and validation of both these approaches to objective toolmark identification are hindered by a lack of access to toolmark data sets that 1) represent the large variety of ballistic toolmarks encountered by forensic examiners, and 2) represent challenging identification scenarios, such as those posed by consecutively manufactured firearms components. It is not economically feasible for individual companies or institutions to generate their own data sets. This makes it difficult for these entities to develop and evaluate solutions applicable to a broad range of scenarios, and makes the development of a statistical foundation for confidence limits (error rates) difficult. During a symposium held at NIST entitled "Measurement Science and Standards in Forensic Firearms Analysis 2012," one of the priority requests from the attendees was the construction of a database where bullet and cartridge case surface data can be shared between researchers to facilitate testing, refinement, and comparison of new systems, methods, and algorithms.

The proposed database will provide the representative variety of toolmark data required. The database will consist of indexed surface data acquired at the National Institute of Standards and Technology (NIST) using state-of-the-art instruments and measurement procedures.

Bio: Xiaoyu Alan Zheng is a Mechanical Engineer in the Engineering Physics Division of the National Institute of Standards and Technology (NIST). He has a B.S. and M.S. in Mechanical Engineering and focuses his research on objective measurements and analysis of 2D/3D ballistics toolmarks. He is currently a member of the Subcommittee on Firearms & Toolmarks in the NIST OSACs as well as a Technical Advisor for AFTE.

Objective Descriptions and Subjective Meanings: The Role of Databases

Steve Lund, PhD, Statistical Engineering Division, NIST

Abstract: Forensic examiners have traditionally relied upon their training and experience to interpret evidence. In recent years, there has been increased public demand for objective information to help characterize the meaning of evidence. This movement has brought about increased interest in database formation and utilization. In this talk, we discuss interactions between training, experience, databases, and the value of forensic trace evidence, as well as limitations of data and some potential misconceptions regarding the use of statistics and probability models.

Bio: Steve Lund is a statistician in the Statistical Engineering Division at NIST. He is a member of the OSAC Footwear and Tire Subcommittee and, in collaboration with colleague Hari Iyer, is generally interested in statistical perspectives of forensic evidence interpretation.

Fiber/Hair Panel

Challenges and Opportunities in Database Design and Inter-laboratory Studies on Trace Evidence Fibers

Steve Morgan, PhD, University of South Carolina

Abstract: The discovery and identification of a fiber as a particular polymer (e.g., acrylic, cotton, nylon, polyester) may not, of itself, provide much support for a forensic investigation. The probative value of fibers found at a crime scene depends on their uniqueness relative to the fiber background in the absence of the crime. What is required is information that makes trace evidence more specific and discriminating. Developing databases for storing and making information on trace evidence fibers is perhaps the best approach, but how many trace evidence laboratories have time and resources to participate in such efforts? Databases of such fiber characterization data cannot be without difficulties and compromises: where are fibers to be acquired, and do measurements from a single lab provide data representative across the reality of numerous labs?

The transfer of multivariate classification models between laboratories can save time and resources in forensic analyses. We have conducted interlaboratory studies to evaluate the application of machine learning tools to comparison of forensic fiber examinations based on UV/visible microspectrophotometry/fluorescence. The results of this work provide statistical measures of dissimilarity of fiber spectra along with visualization of comparisons to support decision-making. A serious limitation to wider use of classification techniques is that the new practitioner often faces a steep learning curve in both comprehending and using available software. We have developed some application programs that offer a user-friendly interface and intuitive results panels for interactive exploration of the utility of pattern recognition and demonstrate their applicability to several data sets.

Bio: Stephen L. Morgan is a Professor in the Department of Chemistry & Biochemistry at the University of South Carolina. He received a B.S in Chemistry from Duke University (1971), and M.S. and Ph.D. degrees (1974, 1975) from Emory University. His research has involved forensic analytical chemistry (spectroscopy and separations for trace evidence such as fibers, dyes and inks, drugs, blood), analytical toxicology, analytical microbiology, chemometrics, and polymer analysis. Dr. Morgan has published 131 papers, 15 book chapters, and six books. Dr. Morgan has taught numerous short courses on experimental design and statistics for the American Chemical Society and other organizations. In 2008, he was named a Sigma Xi Distinguished Lecturer, and his research has been featured on CNN and NPR Science Friday. He was recognized as the South Carolina Chemist of the Year by the SC Section of the American Chemical Society in 2011. He currently serves on the Chemistry and Instrumental Analysis NIST-OSAC committee.

Historical Review of Hair Analysis and Current Research Collections

Sandy Koch, PSU

Abstract: This presentation will review the multidisciplinary background of hair analysis and discuss historical collections, which many of our current forensic descriptions were developed from. University researchers are actively collecting hair samples, including a human hair research repository. These current projects will ultimately provide a much wider catalog of variation in human hair morphology based on vouchered specimens. The process for requesting samples from the repository and other museum and University collections will be discussed as these samples may be of interest to forensic researchers and includes not just the hair samples but data on the donor such as their genetic ancestry, mitochondrial haplogroup, age, sex, hair treatment information, etc.

Bio: Sandra Koch has a Master's in Forensic Science and worked for the FBI Laboratory Trace Evidence Unit from 1997 until 2013. She is a Fellow of the American Academy of Forensic Sciences, a founding member of the American Society of Trace Evidence Examiners and is certified by the American Board of Criminalistics in hairs and fibers. Sandra is a past member of the Scientific Working Group for Materials Analysis (SWGMAT) and is currently a member of the OSAC Materials (trace) subgroup. Currently Sandra is pursuing a PhD in biological anthropology at the Pennsylvania State University, using her background in microscopical analysis to integrate forensic and anthropological analysis of hair.

Private Sector Resources Panel

Chemical Analysis and Databases in the Paint Industry

Richard Simon, Valspar

Abstract: As a leading paint supplier into many different consumer and industrial markets Valspar performs R&D into wide variety of technology areas. The Analytical Chemistry laboratories are a key R&D and technical service resource by determining mechanisms of action, understanding failure modes, and solving customer related chemical problems. This discussion will focus the types of analysis and data which are important to the paint industry, what types of databases are used, and what new databases are currently being built in our laboratory to help solve problems in the future.

Bio: Rich Simon joined Valspar in 2005 and is currently the head of their Global Analytical Network. In this role he manages the Corporate Analytical Laboratory in Minneapolis, MN and coordinates analytical efforts between Valspar's eight other global analytical laboratories. Prior to joining Valspar he worked for The Clorox Company in Pleasanton, CA managing their GC and GC/MS laboratories in their analytical lab and leading product development projects in their Home Care Division. He earned degrees in Chemistry and Criminal Justice from the University of Wisconsin—Platteville in 1995 and a Doctorate in Analytical Chemistry from the University of Arizona in 1999.

Paint Materials and Processes from an Automotive OEM Perspective

Mark Nichols, Ford

Abstract: Automotive coatings possess several characteristics that make them useful for forensic analysis. The colors, layering scenario, composition, and state of degradation can all be used to deduce facts about the vehicle from which they came. The manufacturing process plays a significant role in the layering scenario, and several exceptions to the manufacturing process are important to understand. As the chemical composition of a coatings changes over time, infrared and UV spectroscopy can be used to deduce the age of a coating. Finally, color and pigmentation are critical elements of an automotive paint system and the uniqueness of those colors depends on the model year, assembly plant, and vehicle model.

Bio: Dr. Nichols received his B.S. from the University of Michigan in 1987, his M.S. from the University of Illinois in 1989, and his Ph.D. from the University of Michigan in 1992. All his degrees are in Materials Science and Engineering. Dr. Nichols is currently the Technical Leader of the Paint and Corrosion Research group in Ford's Research and Advanced Engineering organization.

Thermo Scientific [Nicolet] FT-IR and Raman Databases (Libraries) for Forensic Applications

Mike Pannella, Senior Sales Representative, Molecular Spectroscopy, ThermoFisher

Abstract: There are a wide variety of FT-IR and Raman spectral library (databases) collections available for solids, liquids and gases. Thermo Scientific develops sells and services its own library collections and offers its libraries to customers using all IR and Raman instruments available. The wide variety of unique, high quality spectral library collections compromise a wide selection of material characterization of interest to forensic scientists including – Polymers & Coatings, Industrial Materials, Household Products, Biochemical's, Fibers and Adhesives, Pharmaceuticals – Excipients, Designer and Controlled Substances, Explosives and Weapons. Presentation will cover parameters for library development and creation of Qualitative and Quantitative Databases. Identification Tools that are widely utilized for library searches via interpretation algorithms and library knowledge-base of spectra will be discussed in identifying materials.

Bio: As a Biology and Chemistry major at Towson University, Mike's first job out of school was working for the US Army, Medical Research for Chemical Defense in their Analytical Chemistry Department as a Chemist. He was hired to evaluate and implement FT-IR Spectrometer technology for the US Army. Mike has authored/coauthored Journal Papers in "Applied Spectroscopy", Analytical Chemistry", Journal of Chromatography, etc. on FT-IR and Chromatography techniques and developments. Mike moved on as the Research Chemist for The University of Maryland School of Pharmacy in Baltimore utilizing FT-IR, Raman, HPLC and GC instrumentation. Mike finally went into Sales and has been supporting customers on FT-IR, Raman, IR/Raman Microscopy/Imaging and NMR for some 24 years in the mid-Atlantic area. Mike lives in Maryland with his wife and two children. He works out of the Thermo Scientific Customer Support Laboratories in Lanham, Maryland.

Glass/Paint/Tape

The State of Data in Glass Analysis

Jose Almirall, PhD, Florida International University (FIU)

Abstract: Refractive index and elemental concentration data from glass analysis can be used as evidence of association between glass samples in the forensic context. Elemental analysis using sensitive analytical techniques such as uXRF and LA-ICP-MS provides very good means of comparing glass samples when using the ASTM methods (E2926-13 and E2927-13, respectively) for producing the measurements and comparing the data. Interrogation of databases to determine the relative frequency of "matching" RI and elemental concentration profiles can provide additional information to the court regarding the significance of the positive comparison between a crime sample and a known source. Databases can assist the forensic scientist to better express significance so that the value of the evidence is not overstated or understated.

Bio: Dr. José R. Almirall is a Professor in the Department of Chemistry and Biochemistry and Director of the International Forensic Research Institute (IFRI) at Florida International University. He was a practicing forensic scientist at the Miami-Dade Police Department Crime Laboratory for 12 years, where he testified in over 100 criminal cases in state and federal courts prior to his academic appointment at FIU in 1998. Professor Almirall has authored one book and ~ 120 peer-reviewed scientific publications in the field of analytical and forensic chemistry. The interests of Prof. Almirall's research group include fundamental analytical chemistry and the development of analytical chemistry tools for use in forensic chemistry including materials analysis, trace detection and analysis of drugs and explosives. Prof. Almirall is a Fellow of the American Academy of Forensic Sciences (AAFS) since 2004 and a member since 1995. He was the founding chairman of the Forensic Science Education Programs Accreditation Commission (FEPAC) of the AAFS, past Chair of the FBI-sponsored Scientific Working Group on Materials (SWGMAT) Glass subgroup, serves as co-editor-in Chief of Forensic Chemistry and on the editorial boards of two other forensic science journals. Dr. Almirall has served as a consultant to the United Nations Office on Drugs and Crime (UNODC) and to the International Atomic Energy Agency (IAEA) on forensic science matters. He was appointed to serve on the Forensic Science Standards Board (FSSB) of the Organization of Scientific Area Committees (OSAC) in 2015. He has trained 8 post-doctoral fellows, 25 PhD students, 20 MS students and more than 30 undergraduate students in forensic chemistry research.

EU Tape, Paint, Glass Data Sets

Stefan Becker, PhD, Bundeskriminalamt (BKA) Wiesbaden/Germany

Abstract: The presentation will outline the current activities of the European Union with respect to forensic databases. In this context the development of the R&D activities of the European Network of Forensic Science Institutes (ENFSI) on forensic databases will be described. The presentation will outline the activities of the ENFSI Expert Working Group Paint & Glass (EPG) in the field of automotive paint. The European Collection of Automotive Paint (EUCAP) will be described. Furthermore, the international cooperation between EUCAP and the North American counterpart PDQ will be described. Activities of data collection in other fields such as tape and glass will be reported.

Bio: Stefan Becker studied chemistry and joined the Forensic Science Institute of German Federal Criminal Police Office (Bundeskriminalamt) in 1997. After serving as a forensic trace evidence expert for six years he hold a position as international liaison officer of the Forensic Science Institute. He then became head of the "Inorganic material

analysis unit" for eight years and was promoted to the head of the "Documents and Media Technology" section in 2013. Since 2015 he is the head of the "Material analysis & trace evidence" section and one the deputy directors of the Forensic Science Institute. Starting from 2001 Dr. Becker has been member of the steering committee of the ENFSI Expert Working Group Paint & Glass (EPG) and was chairing the EPG from 2011-2013. For over a decade he has been a member of SWGMAT (Scientific Working Group for Materials Analysis).

Paint Data Query - International Forensic Automotive Paint Database

Tamara Hodgins, Royal Canadian Mounted Police (RCMP)

Abstract: Paint Data Query (PDQ) is an international automotive paint database developed and maintained by the Royal Canadian Mounted Police (RCMP). It is used by the RCMP and over 100 forensic laboratories worldwide as an investigative aid to identify the possible manufacturing plant and year range of a suspect vehicle from paint recovered at the scene of hit-and-run incidents. In this presentation we will look at PDQ, the structure, maintenance and distribution of the program, the partnership model that allows PDQ to obtain over 2500 samples per year from various regions and countries, strategies to sort and store the samples as well as strategies for populating the database to ensure diversity and success.

Bio: A graduate from the Chemical Engineering Program at Cambrian College in Sudbury, Canada, Tamara Hodgins has been a Civilian Member of the Royal Canadian Mounted Police working in the National Forensic Laboratory Service (NFLS) Trace Evidence section since 2002. Tamara began her career at the Ottawa laboratory with the Paint Data Query (PDQ) Maintenance Team, a team dedicated to the building, maintenance and support of the international automotive paint database and was transferred to the NFLS Edmonton along with the PDQ program in 2003. Tamara has been the PDQ Maintenance Team Supervisor since 2009 and has spent her career specializing in automotive paint, assisting scientists locally and internationally with casework involving hit and runs for over 14 years.

Application of Spectrochemical Profiles for the Forensic Characterization of Electrical Tapes

Tatiana Trejos, PhD, FIU

Abstract: A Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) method was developed and validated for the chemical characterization of electrical tape backings. The utility of LA-ICP-MS was compared to SEM-EDS, FTIR and Py-GC-MS in terms of error rates, selectivity, discrimination, characterization and informing power. The elemental profiles of 94 electrical tape backings were used to populate the database and to test the performance of automated and searchable comparison algorithms. The results show that LA-ICP-MS complements current protocols for the characterization and comparison of electrical tapes and provides a good alternative for quick screening and for supporting leading and intelligence investigations.

Bio: Dr. Tatiana Trejos is Associate Professor at the Department of Forensic and Investigative Science at West Virginia University. Dr. Trejos has over 17 years of experience as forensic scientist. Tatiana has served in different scientific working groups, including the NIJ funded Elemental Analysis Working Group (EAGW) and the OSAC Trace Materials subcommittee. Dr. Trejos main research interest includes the analysis and data interpretation of chemical signatures of forensic evidence such as glass, paint, tape, inks, paper and other materials. Tatiana Trejos has authored 28 peer reviewed scientific publications and 3 book chapters in the field of forensic chemistry and has presented over 75 oral presentations and posters at scientific meetings in North America, Central America, South America and Europe.

A Local Forensic Laboratory's Perspective on Trace Evidence Databases

Chip Pollock, Sacramento District Attorney's Office

Abstract: This presentation will focus on the perspective a local forensic has with trace evidence databases. The presentation will provide a brief overview on glass, automotive paint, and tape databases, and an overview of how a local forensic laboratory is developing a glass database and how they may use the database in forensic casework.

Bio: Edward "Chip" Pollock has over 25 years of experience in forensic science, and currently works as a supervising criminalist for the Sacramento County District Attorney's Office Laboratory of Forensic Services. His areas of expertise include the analyses of trace evidence, forensic microscopy, crime scene processing and reconstruction. Mr. Pollock serves as a member of the Chemistry / Instrumental Analysis Scientific Area Committee (SAC) – Materials (Trace) Subcommittee within the Organization of Scientific Area Committee (OSAC). Mr. Pollock is certified as a Fellow in general criminalistics from the American Board of Criminalistics.

Explosives/Ignitable Liquids

The State of Data in Explosives and Ignitable Liquids

Michael Sigman, PhD, National Center for Forensic Science and Department of Chemistry
University of Central Florida

Abstract: The National Center for Forensic Science (NCFS) at the University of Central Florida has developed and maintains databases on smokeless powders, ignitable liquids and pyrolysis products. These databases have been developed in collaboration with the forensic community through the Scientific Working Group for Fire and Explosion (SWGFEX). The databases are open and freely accessed online at http://ncfs.ucf.edu. This talk will primarily address the content of the Smokeless Powders Database, the Ignitable Liquids Reference Collection and Database (ILRC), the International Database of Ignitable Liquids and the Substrates Database. In addition, I will discuss the need for expansion of these databases and the use of the databases in addressing the needs of the forensic community.

Bio: Dr. Sigman earned a B.S. in Chemistry at Southwest Missouri State University in 1982, and a Ph.D. in Chemistry at Florida State University in 1986. He was awarded an NIH Postdoctoral Fellowship to study at the University of Illinois, Urbana-Champaign, and the University of Chicago. He worked at Dow Chemical Co. and Oak Ridge National Laboratory before moving to University of Central Florida in 2002 as an associate professor. In 2013 he was promoted to the rank of professor and appointed as Director of the National Center for Forensic Science. His research is primarily in the forensic science areas of explosives and fire debris analysis. In 2015, Dr. Sigman serves on the OSAC Analysis of Explosives and Fire Debris Subcommittee.

University of Rhode Island Explosives Databases

Jimmie Oxley, PhD, University of Rhode Island

Bio: Dr. Jimmie Carol Oxley is Professor of Chemistry at the University of Rhode Island (URI), co- Director of the Forensic Science Partnership of URI and former co-director of the Department of Homeland Security (DHS) Center of Excellence (CoE) in Explosive Detection, Mitigation, and Response. Dr. Oxley earned a Ph.D. from the University of British Columbia (Chemistry) and joined the faculty of New Mexico Institute of Mining & Technology (NMT) where she founded a Ph.D. program in explosives and created a Thermal Hazards Research group. Oxley's lab specializes in the study of energetic materials—explosives, propellants, pyrotechnics.

Trace Drugs, Minerals, Biologicals, and other Misc. Particles

The State of Data - Beyond Hair, Fibers, Paint, and Glass

Skip Palenik, Microtrace LLC

Abstract: "DNA analyzes one molecule, trace evidence handles the rest." This unofficial slogan of the forensic trace evidence community is a bold statement, but if one stops to consider it, at any given time, we are each surrounded by hundreds of materials and thousands of chemical compounds. Each of these, whether highly engineered to achieve specific properties or naturally occurring, has a story to tell. From a single mineral grain on a sandy beach to a pigmented chip of mulch, virtually any material has the potential to play a significant role in a criminal trial. Yet the ability to exploit this information requires the foresight to recognize potential evidence, the technical skills to analyze it, and the scientific creativity to exploit the significance of this information. In addition to the potential of direct applications to casework, reference collections are a requisite to developing such skills. Given that this session, "Minerals, Biologicals, and Other Materials," represents the vast majority of materials in the world, there is a great number of materials to exploit. Yet to do so requires a fundamental understanding of such materials and a thoughtful approach, which the development and curation of such databases can enable. This talk will provide examples and details of our own databases that span the vast world of materials that fall outside of the typical sub-disciplines of trace evidence and the way they may be utilized.

Biography: Skip Palenik has had a lifelong fascination with the microscope that started when he received his first instrument at the age of eight. Since then he has devoted himself to increasing his knowledge of analytical microscopy and microchemistry and applying it to the solution of real world problems, especially those of forensic interest. He was fortunate in having worked closely with his mentor, Dr. Walter McCrone, for over thirty years and to have studied forensic microscopy with Dr. Max Frei-Sulzer of Zurich, a disciple of Dr. Edmond Locard of Lyon. Skip has been teaching analytical microscopy to forensic scientists for more than thirty years and has published numerous scientific articles and book chapters on the applications of chemical and forensic microscopy. His most recent contribution is a chapter on the use of heavy minerals in forensic science published by Elsevier. He has also played a significant role in numerous criminal investigations including the Atlanta Child Murders, the Air India Bombing, Jon Benet Ramsey case, Narita Airport bombing (Tokyo), Hillside Strangler (Los Angeles) cases, Oklahoma City bombing, Ivan the Terrible (Jerusalem), Assassination of Dr. Martin Luther King (reinvestigation by U.S. House Select Committee on Assassinations), the Unabomber, the disappearance of Helen Brach, The "Kiki" Camarena Murder Case and the Green River Serial Murders. He established Microtrace in 1992 to provide a resource for organizations and individuals in need of scientific services involving the analysis of microscopic trace evidence. His special research interests are the identification of single small particles, small amounts of complete unknowns and tracing dust and soil back to their origins. He is the 2009 recipient of the Paul L. Kirk Award, the highest award given by the criminalistics section of the American Academy of Forensic Sciences, the 2013 Ernst Abbe Award for outstanding contributions to microscopy, the 2013 Edmund Locard Award presented by the American Society of Trace Evidence Examiners, and the Chamot Medal in chemical microscopy in 2010.

Non-Forensic Databases for Interpretation of Forensic Soils

Libby Stern, PhD, FBI

Abstract: Forensic examinations natural materials like soils, unlike other types of trace evidence, benefit from data created for non-forensic purposes. This presentation focuses on databases useful for the examination and interpretation of the mineralogical components of soils. The biological and anthropogenic components of soils are also important parts of forensic examinations but are not addressed here. There is no need to generate new databases to identify minerals because the physical, chemical and spectral properties of minerals are well known. Among the better mineralogical databases are: RRUFF, ICDD, MSA, and the Clay Source Project. Further, several databases characterize distribution of minerals and soil properties across the U.S. (This talk does not address the similar databases outside of the U.S.) Forensic soil examinations can benefit by comparison to surficial and bedrock geology maps, their legends and descriptions. The National Geologic Map Database (NGMDB) allows access to most geologic maps as scanned images or GIS data. The NGMDB excludes maps from certain states, but the Association

of American State Geologists is a portal to some of these. A geochemical and mineralogical survey of soils in the contiguous US was completed 3 years ago by a team from the USGS (DS 801/OFR 2014–1082) providing a resource for comparison with forensic soils. Although this dataset contains over 4800 locations, this may be inadequate for many forensic cases. The clay mineral distributions may be most informative as clays tend to be controlled largely by landscape age and climate, factors that vary little across large portions of the landscape. The USDA has characterized US soils for agricultural and civil engineering applications, but some of these data are useful for comparison to forensic soil samples, including soils characterized at specific locations (NCSS) and soil surveys, in which properties of all of the soils in a region are interpolated. The soil survey data is complex, and largely irrelevant to forensic application, but certain fields are useful, provided the user recognizes that these data are inferences, and not verified at all locations. Among the forensically useful properties in the database versions of soil surveys (SSURGO/STATSGO) are: texture, pH, carbonate, gypsum, and parent material. Some soils surveys contain additional mineralogical information. Unfortunately, soil color, an important property for forensic examinations, is not a direct field in the database version of soil surveys, but may be linked via the Official Soil Series Descriptions. Despite the wealth of data available for forensic soil interpretation, the sample size and methods used sometimes make application of the available data challenging. Three cases in which soil databases enhance forensic reports are described.

Bio: Libby Stern is currently a research chemist at the FBI Laboratory. Her current research efforts focus on forensic applications of isotope ratio analyses and integration of spatial data into of forensic soil examination reports, both to provide context to enhance geographic attribution for lead development. Libby's educational background is in earth science and geochemistry (BA, MS, PhD). Some of her prior research focused on soils, paleosols, and earth surface processes.

Particulate and Biological Databases from a Geolocation Perspective

Andy Bowen, US Postal Service

Abstract: This presentation will discuss a number of databases and other resources that proved useful during seven years of research into geographic sourcing of items based on adhering trace evidence. The resources described were of value for the identification of a wide range of particles encountered in soil and dust samples, and/or for the interpretation of their significance from a geographic origin perspective. While the primary goal of the project was geographic sourcing, these same databases and resources have potential value in more traditional trace evidence examination as well. In addition to their utility for identification of particulate samples that fall outside of the traditional trace evidence sub-disciplines, some of these resources could be used by trace evidence examiners to help interpret the significance of associations involving a variety of particle types.

Bio: Andrew Bowen is currently a senior forensic chemist for the U.S. Postal Inspection Service. Prior to this position he spent seven years as a forensic scientist for Stoney Forensic, Inc., a private forensic science consulting company. He started his career as a microscopist and instructor for the McCrone Research Institute, a not-for-profit teaching organization, where he was employed for three years. He is a member and Past President of the American Society of Trace Evidence Examiners, a Member of the American Association of Forensic Sciences, and is a Fellow of the American Board of Criminalistics in the area of Comprehensive Criminalistics. His education includes a B.S. in chemistry from the University of Virginia and a M.S. in forensic science from the University of Illinois at Chicago.

Database Development and Product Variability in Lubricant Materials

Jeffrey Dake, Defense Forensic Science Center

Abstract: Attendees will be exposed to the foundational basis for the analysis of lubricant materials and the discrimination of lubricant products. An overview of database initiatives at DFSC for the chemical composition of

lubricant products will be detailed. Analytical techniques for improved discrimination will be discussed. The challenges associated with interpretation will be covered. Finally, future initiatives will be detailed.

Bio: Jeffrey Dake is a Chemistry Technical Leader employed by the Defense Forensic Science Center, working in the Office of Quality, Initiatives, and Training. He performs casework in the areas of: lubricants, explosives, ethanol quant, and miscellaneous chemical identification.

A Modern Compendium of Microcrystal Tests for Illicit Drugs and Diverted Pharmaceuticals

Sebastian Sparenga, McCrone Research Institute

Abstract: "A Modern Compendium of Microcrystal Tests for Illicit Drugs and Diverted Pharmaceuticals" contains 19 drugs for which microcrystal tests using various reagents have been previously developed. It describes in detail the microcrystals formed from each test and includes photomicrographs, morphology illustrations, optical properties, notes and infrared spectra of the microcrystals. Information about known microcrystal tests and reference material from numerous sources spanning past decades were located and evaluated, including textbooks, journal articles, and standard operating procedures. Many of these are out of print and not easily accessible. Such references often contain few photomicrographs of microcrystals, and their reagent formulations and procedures may be difficult to interpret. There is also a lack of information regarding potential interferences from other drugs that may be present in combination with pharmaceuticals or from adulterants in street drug samples. The following topics are included for each drug: reagents and formulation; test methods; sensitivity of the test and limit of detection; time required for crystal formation; evaluation of the tests in the presence of common excipients, diluents and adulterants; and evaluation of the tests for drugs from selected pharmaceutical delivery devices, e.g. tablets, capsules, gels, transdermal patches and oral solutions. This project was funded through a cooperative agreement with the National Institute of Justice (2011-DN-BX-K528) and the compendium is available free for download on McCrone Research Institute's website http://www.mcri.org as a PDF.

Bio: Sebastian Sparenga is a senior research microscopist and instructor at the McCrone Research Institute in Chicago, where he has been employed since 2004. The microscopy courses he teaches include Applied Polarized Light Microscopy, Microscopical Identification of Asbestos, Particle Manipulation and Sample Preparation for Microanalytical Techniques, Digital Imaging, Microscope Cleaning, and specialized training for the National Guard Bureau. Sparenga also performs microanalytical research on a variety of topics, including microcrystal tests for illicit drugs, which he will be discussing in his presentation.

Comprehensive Analytical Tools for the Identification of Emerging Drugs of Abuse

Luis Arroyo, FIU

Abstract: Analysis and identification of emerging drugs of abuse involves the development of databases where the final user can retrieve intelligent and useful data to avoid the necessity of purchasing an arsenal of analytical standards, and also for facilitating the creation of analytical methods in the working laboratory. This presentation describes our experience in the development of forensic science databases specifically targeting designer drugs. We will also discuss the use of several mass spectrometric platforms, including LC-QQQ-MS and LC-QTOF, and how these databases could be commercialized as a final product.

Bio:

- Assistant Professor Forensic and Investigative Sciences at West Virginia University.
- Former Researcher and associate director of the Forensic and Analytical Toxicology Facility (FATF) at the International Forensic Research Institute (IFRI), Department of Chemistry and Biochemistry, Florida International University.

- More than 12 years of experience as researcher and instructor for analytical chemists and forensic practitioners.
- 16 years of experience in mass spectrometry instrumentation including: Gas Chromatography-Mass Spectrometry (GC/MS) and Liquid chromatography mass spectrometry (LC/MS), Matrix Assisted Laser Desorption Ionization (MALDI), ICP-MS and LA-ICP-MS.
- Degree in chemistry from University of Costa Rica.
- Master in Science in Forensic Science (MSFS) from Florida International University.
- Ph.D. in Chemistry with forensic Science track from Florida International University.